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Original Article

Effect of Bajakah Tea Extract (*Spatholobus littoralis* Hassk) on High Density Lipoprotein, Triglyceride and Total Cholesterol Levels in Male Wistar Rats

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ABSTRACT

Hyperlipidemia is the high concentrations of low-density lipoprotein, cholesterol, and triglycerides in the blood. Furthermore, hyperlipidemia has a risk factor for cardiovascular complications through atherosclerosis that triggers coronary heart disease (CHD). *Spatholobus littoralis Hassk* known as Bajakah tea is a plant with high antioxidant content and acts as an HMG-CoA reductase inhibitor to suppress lipid metabolism disorders, increase HDL levels, and reduce triglycerides and total cholesterol. Experimental and posttest control group design methods were used to obtain 24 male Wistar rats. Furthermore, the experimental animals were randomly divided into 4 groups, namely K1 (normal rats), K2 (hyperlipidemia rats), K3 (hyperlipidemic rats + pirated tea extract dose 9 mg/200gramBW/day), and K4 (hyperlipidemic rats + simvastatin dose 0.18 mg/200 gBW/day). The study was conducted at the Center for Food and Nutrition Studies Laboratory, Gajah Mada University, Yogyakarta. Data levels of HDL, triglycerides, and total cholesterol were analyzed using the One Way Anova test and LSD post hoc to determine between groups. The results showed that an increase in triglyceride and total cholesterol and a decrease in HDL levels in the K2 group compared to the K1. Triglyceride and total cholesterol decreased in groups K3 and K4 compared to K2, and HDL levels increased in groups K3 and K4 compared to K2. Meanwhile, the results of the analysis obtained p value <0.05. This study concluded that the administration of Bajakah tea extract at a dose of 9 mg/200gram BW/day for 14 days increase HDL, reduce triglyceride and total cholesterol levels (p<0,05).
Key words: Hyperlipidemia, Pirated tea extract, HDL levels, Triglycerides, Total cholesterol.

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BACKGROUND

Hyperlipidemia is a disease that refers to high concentrations of low-density lipoprotein, cholesterol, and triglycerides in the blood.[1] Decreased High Density Lipoprotein (HDL) levels can cause atherosclerosis and coronary heart disease (CHD).[2] Hyperlipidemia is also a risk factor for CHD through atherosclerosis. Clinically, this CHD thickens of blood vessel walls, narrows the lumens, and hardens the arteries due to an imbalance in the amount of cholesterol.[3] Therefore, the treatment of hyperlipidemia using a statin drug such as simvastatin need to be conducted.[4]

Bajakah tampala known as *Spatholobus littoralis Hassk*, is a plant that grows in Central Kalimantan with many benefits but is not widely used. The preliminary tests showed the presence of phenols, flavonoids, saponins, and tannins, and this can treat cardiovascular disease, cancer, and diabetes.[5] One of the active compounds is flavonoids and other polyphenols with a strong antioxidant activity capable of inhibiting free radicals.[6] The flavonoids, ethyl acetate, and N-hexane levels in the pirated extract have very strong antioxidant activity.[7] Furthermore, the activity of 3-hydroxy-3-methyl-glutaryl-coenzymeA (HMG-CoA) reductase in cholesterol biosynthesis is inhibited by flavonoid compounds.[8]

Flavonoids can inhibit HMG-CoA reductase, but study on the effect of Bajakah tea extract on HDL levels is limited.[9] The content of Bajakah tea is related to antioxidant activity, and the effects are known to affect the lipid fraction of hyperlipidemia due to the wrong diet.[10] Therefore this study determined the effect of Bajakah tea extract on High Density Lipoprotein (HDL), triglyceride, and total cholesterol levels in hyperlipidemic rats.

MATERIALS AND METHODS

Experimental study design with *Post-Test Control Group Design*.

Making bajakah extract

To produce the Bajakah extract, 100 mg of the sawdust was soaked in a vessel with (1:3) 70% ethanol and covered tightly for three days. Subsequently, it is stirred and closed again tightly. It was filtered and sorted to obtain the filtrate and dregs of the ethanol extract. Remaceration of the pulp was carried out using 70% ethanol, ensuring the volume was the same while occasionally stirring before collecting the filtrate. The result of the concentrated extract was carried out using a rotary evaporator and water bath.

Experimental animal

Determination of high-fat feed dosage (Hyperlipidemia)

High-fat feed that can be used is quail egg yolk because it contains the highest total cholesterol. The egg yolk dose used is 10 ml/KgBW/day and was given to all groups except the control for 14 days. The dose of quail egg yolk in rats weighing 200 grams is 2 mL.

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Simvastatin dosage

In humans, the dose of simvastatin is 10 mg/70 kg body weight/day. The calculation for rats weighing 200 grams becomes: = 10 mg x 0.018 = 0.18 mg/200 gBW/day.

Giving treatment

Male Wistar rats used met the criteria of 2 months old, body weight around 180-220 g, physically healthy, active movement, normal eating and drinking, no injuries, or defects. A total of 24 rats were randomly divided into 4 groups of 6.

Group 1 (K1):	Wistar strain male white rats received standard feed + drink ad *libitum* diet for 14 days
Group 2 (K2):	Wistar male white rats which received standard diet + drink ad *libitum* + 2 mL quail egg yolk for 14 days
Group 3 (K3):	Wistar male white rats which received a standard diet + drink ad *libitum* + 2 mL quail egg yolk + tea extract of bajakah at a dose of 9 mg/200gBW/day for 14 days
Group 4 (K4):	Wistar male white rats which received standard diet + drink ad *libitum* + 2 mL quail egg yolk + simvastatin dose 0.18 mg/200 gBW/day for 14 days

On the 15th day, blood was drawn to measure HDL, triglycerides, and total cholesterol levels.

Blood drawing method

The equipment used is sterile microhematocrit tubes, blood collection bottles, and sterile cotton. Blood was taken by inserting a microhematocrit tube into the ophthalmic vein in the corner of the rat's eyeball periorbital and slowly rotated until about 2cc was collected in Eppendorf. After the required amount was obtained, the microhematocrit tube was closed. Furthermore, the remaining blood in the corner of the rat's eyeball was cleaned using sterile cotton.

How to check HDL, triglyceride, and total cholesterol levels

HDL, triglyceride, and total cholesterol levels were checked with an Automatic Spectrophotometer Unit.

Study place

The study was conducted at the Central Laboratory of Food and Nutrition Studies, Gadjah Mada University, Yogyakarta.

Statistical analysis

The measurement of HDL, triglycerides, and total cholesterol were tested for normality with *Shapiro-Wilk* and homogeneity test and *Leuvene*. The data levels were normally distributed and homogeneous. The, data were analyzed by the *One Way Anova* and continued to the *Post Hoc LSD* test to determine differences between groups.[11]

Ethics

This study received a permit *(ethical clearance)* from the Medical/ Health Research Bioethics Commission, Faculty of Medicine, Unissula Semarang, with number 240/VIII/2021/Commission on Bioethics.

THE RESULTS OF THE STUDY

The effect of young coconut water on the average levels of HDL, triglycerides, and total cholesterol is shown in table 1.

Table 1 and Figure 1 showed that group K2 had the lowest average HDL level (23.53±2.05 mg/dL) while K1 was the highest (86.14±2.50 mg/dL), K3 and K4 showed lower average levels (75.69±3.64 mg/dL and 63.40±3.89 mg/dL) compared to K2 but higher than K1, the mean

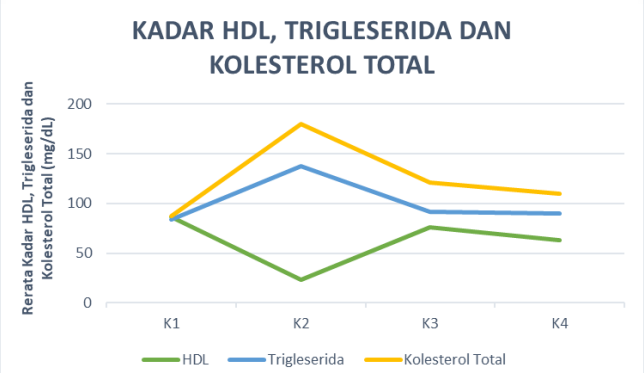

Figure 1: The average HDL, triglyceride, and total cholesterol levels in groups K1, K2, K3 and K4.

increase in HDL levels between K2 and K3 = 52.16 mg/dL, and between K2 and K4 = 39.87 mg/dL.

The average triglyceride levels in groups K2 and K1 were the highest and lowest at 137.44±5.88 mg/dL and 83.58±3.8 mg/dL, K3 and K4 showed the lower average levels at 91.67±2.47 mg/dL and 89.55±2.11 mg /dL and compared to K2 but higher than K1, the decreased magnitude in the average triglyceride levels between K2 and K3 = 45.77 mg/dL, between K2 and K4 = 47.89 mg/dL.

The highest and lowest average total cholesterol level in the K2 and K1 groups were 180.1±3.95mg/dL and 87.5±3.98 mg/dL, K3 and K4 showed lower average levels at 121.4±5.07 mg/dL and 109.4±3.58 mg/dL, and compared to K2 but higher than K1, the decreased magnitude in the average triglyceride levels between K2 and K3=58.7 mg/dL, between K2 and K4=70.7 mg/dL.

The Anova analysis showed that the administration of Bajakah tea extract at a dose of 9 mg/200gram BW/day for 14 days could increase HDL and reduce triglyceride and total cholesterol levels (p-value <0.05). The average increase in HDL levels by Bajakah tea extract at a dose of 9 mg/200gramBW/day (K3) was higher than simvastatin at 0.18 mg/200gBW/day (K4). The average reduction in triglyceride and total cholesterol levels by simvastatin at a dose of 0.18 mg/200gBW/day (K4) was higher than Bajakah extracts at 9 mg/200gramBW/day (K3).

DISCUSSION

The administration of Bajakah tea extract at a dose of 9 mg/200gram BW/day for 14 days increased HDL and reduced triglyceride levels as well as total cholesterol in hyperlipidemic rats. The hyperlipidemic condition of giving quail egg yolk to rats at a dose of 2 mL/200gBW is in line with previous studies, where the induction of quail egg yolk at the same dose could increase total cholesterol levels from 58.3 mg/dl to 78.5 mg/dl,[12] and reduced HDL from 65 mg/dL to 49.4 mg/dL.[13]

Simvastatin at a dose of 0.18 mg/200gBW/day was given to the treatment group (K4) as the *gold standard*. This drug is an option for treating hyperlipidemia, which has a mechanism of action as an inhibitor of the HMG-CoA reductase enzyme.[14] The mechanism of action in the body by inhibiting 3-hydroxy-3-methylglutaryl HMG-CoA reductase is also responsible for converting HMG-CoA into mevalonate. In the process, it will reduce LDL by 50% and triglyceride levels in the blood. These results align with a study where simvastatin can increase HDL levels in egg-yolk-induced rats.[13]

Bajakah tea extract given at a dose of 9mg/200g for 14 days can increase HDL levels. The group treated with Bajakah tea extract had a higher average HDL level than the quail egg yolk (K2) with p <0.001, meaning

Table 1: The effect of young coconut water on the average levels of HDL, triglycerides, and total cholesterol in 4 (four) groups.

Variable	Group				p-value
	K1	K2	K3	K4	
	Average ±SD	Average ±SD	Average ±SD	Average ±SD	
HDL levels (mg/dL) *Shapiro Wilk* *Levene test* *One way Anova*	86.14±2.50 0.888	23.53±2.05 0.959	75.69±3.64 0.904	63.40±3.89 0.946	>0,05* >0.05** 0,001***
Triglyceride levels (mg/dL) *Shapiro Wilk* *Levene test* *One way Anova*	83.58±3.8 0.647	137.44±5.88 0.925	91.67±2.47 0.866	89.55±2.11 0.527	>0,05* >0.05** 0,001***
Total cholesterol levels (mg/dL) *Shapiro Wilk* *Levene test* *One way Anova*	87.5±3.98 0.866	180.1±3.95 0.324	121.4±5.07 0.433	109.4±3.58 0.693	>0,05* >0.05** 0,0001***

Description: Significant *>0.05
**>0.05
***<0.05

the two groups had a significant difference. In previous studies, the Bajakah tea extract contains flavonoid compounds, saponins, steroids, terpenoids, tannins, and phenols.[15] In a study by Hartanti, flavonoid compounds form hydrogen bonds with amino acids from HMG Co-A reductase.[9] Based on a study by Arysanti *et al*., flavonoid and phenolic compounds can increase HDL and decreasetriglyceride levels through HMG-CoA reductase inhibitors and antioxidants.[16] Other studies have stated that saponins play a role in inhibiting the HMG-CoA reductase and ACAT2 enzymes to initiate the HDL synthesis process.[17] Bajakah extract has antioxidant and antidiabetic compounds including phenols, flavonoids, saponins, and tannins.[16] These results support the studies that showed an increase in HDL, a decrease in triglyceride, and total cholesterol levels after giving the Bajakah tea extract at a dose of 9mg/200gBW/day in rats with hyperlipidemia conditioned by giving quail egg yolk at a dose of 2 mL/200gBW/day for 14 days.

CONCLUSION

The administration of Bajakah tea extract at a dose of 9mg/200gBW/day for 14 days in rats with hyperlipidemia increased HDL, while reducing triglyceride and total cholesterol levels.

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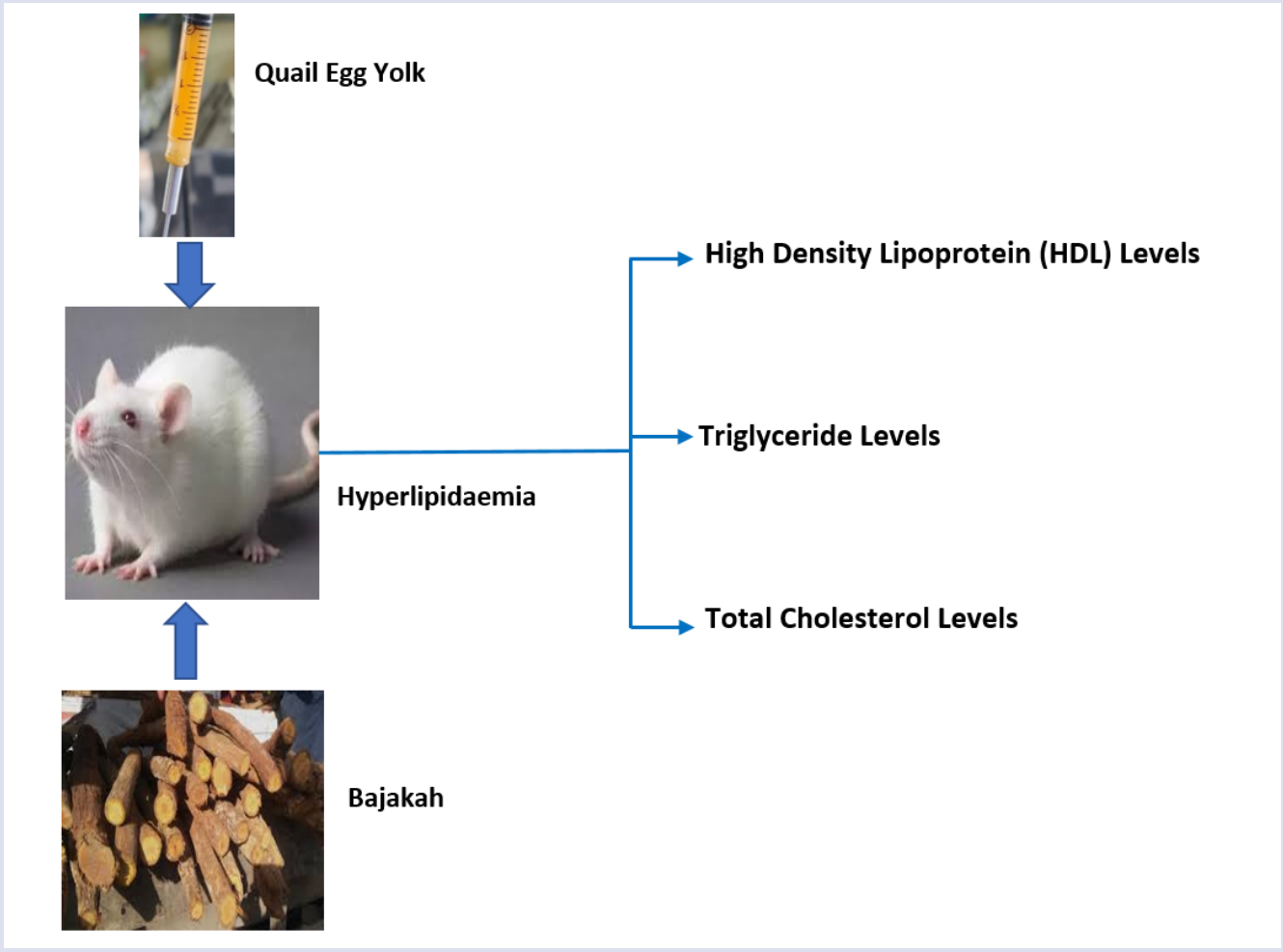
GRAPHICAL ABSTRACT



SUMMARY

Bajakah tea extract significantly increased of HDL level.
Bajakah tea extract significantly decreased of Triglyceride level.
Bajakah tea extract significantly decreased of Total Cholesterol level.

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